

WE CLAIM:

1. A voltage regulated transistor driver in a system further employing a  
5 voltage source and at least one transistor, said voltage regulated transistor driver comprising:  
a variable voltage multiplier operable to generate a regulated driver  
voltage for driving the at least one transistor,  
wherein, in a voltage multiplier mode, the regulated driver voltage  
10 is greater than a source voltage electrically communicated to said voltage regulated  
transistor driver by the voltage source, and  
wherein, in a voltage follower mode, the regulated driver voltage  
approaches the source voltage to thereby equal or approximate the source voltage; and  
a voltage multiplier controller operable to electrically communicate a  
15 multiplier control voltage to said variable voltage multiplier,  
wherein the driver control voltage is indicative of a selection of  
one of the voltage multiplier mode and the voltage follower mode to thereby set said  
variable voltage multiplier in one of the voltage multiplier mode and the voltage follower  
mode.  
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2. The voltage regulated transistor driver of claim 1, wherein the multiplier  
control voltage indicates a selection of the voltage multiplier mode in response to the  
source voltage being less than a high voltage threshold.
- 25 3. The voltage regulated transistor driver of claim 2, wherein the multiplier  
control voltage indicates a selection of a fixed version of the voltage multiplier mode in  
response to the regulated driver voltage being less than a low voltage threshold.

4. The voltage regulated transistor driver of claim 2, wherein the multiplier control voltage indicates a selection of a varying version of the voltage multiplier mode in response to the regulated driver voltage being greater than a low voltage threshold.

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5. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage follower mode in response to the source voltage being greater than a high voltage threshold.

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6. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage multiplier mode in response to the source voltage being less than a high voltage threshold and the regulated driver voltage being less than a low voltage threshold.

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7. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage follower mode in response to the regulated driver voltage or the source voltage being greater than the high voltage threshold.

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8. The voltage regulated transistor driver of claim 1, wherein said voltage multiplier controller includes:

a voltage oscillator operable to generate and electrically communicate the multiplier control voltage to said variable voltage multiplier; and

an oscillation controller operable to electrically communicate an oscillation control voltage to said voltage oscillator, the oscillation control voltage for controlling at least one of a frequency and a duty cycle of the multiplier control voltage.

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9. The voltage regulated transistor driver of claim 8,  
wherein a fixed region of the voltage multiplier mode is defined by  
the source voltage being less than a high voltage threshold and the regulated driver  
5 voltage being less than a low voltage threshold; and  
wherein, in the fixed region of the voltage multiplier mode, the  
frequency and the duty cycle of the multiplier control voltage are fixed.

10. The voltage regulated transistor driver of claim 8,  
10 wherein a varying region of the voltage multiplier mode is defined  
by the source voltage being less than a high voltage threshold and the regulated driver  
voltage being greater than a low voltage threshold; and  
wherein, in the fixed region of the voltage multiplier mode, the  
frequency and the duty cycle of the multiplier control voltage are varied.

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11. The voltage regulated transistor driver of claim 10, wherein the frequency  
and the duty cycle of the multiplier control voltage are varied as function of the relative  
magnitudes of the source voltage and the regulated driver voltage.

20 12. The voltage regulated transistor driver of claim 8,  
wherein, in the voltage follower mode, the frequency and the duty  
cycle of the multiplier control voltage approach zero.

13. The voltage regulated transistor driver of claim 1, wherein said voltage multiplier controller includes:

5 a voltage oscillator operable to generate and electrically communicate the multiplier control voltage to said variable voltage multiplier; and

an oscillation controller operable to electrically communicate an oscillation enable voltage to said voltage oscillator, the oscillation enable voltage for selectively enabling and disabling an oscillation of the multiplier control voltage by said voltage oscillator.

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14. The voltage regulated transistor driver of claim 13, wherein, in the voltage multiplier mode, an oscillation of the multiplier control voltage is enabled.

15. The voltage regulated transistor driver of claim 13,  
15 wherein, in the voltage follower mode, an oscillation of the multiplier control voltage is disabled.

16. The voltage regulated transistor driver of claim 1,  
wherein, in the voltage multiplier mode and in the voltage follower  
20 mode, said variable voltage multiplier includes means for generating the regulated driver voltage as a product of the source voltage and a factor X; and

wherein, in the voltage multiplier mode and in the voltage follower mode, said voltage multiplier controller includes means for controlling the factor X.

17. The voltage regulated transistor driver of claim 1,  
wherein said variable voltage multiplier includes means for  
generating the regulated driver voltage as a product of the source voltage and a factor X;  
5 and

wherein, in the voltage follower mode, said voltage multiplier  
controller includes means for disabling said means for generating the regulated driver  
voltage as a product of the source voltage and a factor X.

10 18. In a system employing a voltage source, a transistor driver, and at least one  
transistor, a method of operating the transistor driver in regulating a drive voltage for  
driving the at least one transistor, the method comprising:

receiving an electrical communication of a source voltage from the voltage  
source; and

15 electrically communicating the regulated driver voltage to the at least one  
transistor,

wherein, in a voltage multiplier mode, the regulated driver voltage  
is greater than the source voltage, and

20 wherein, in a voltage follower mode, the regulated driver voltage  
approaches the source voltage to thereby equal or approximate the source voltage.

19. The method of claim 18, further comprising:  
operating in the voltage multiplier mode in response to the source voltage  
being less than a high voltage threshold.

25 20. The method of claim 19, further comprising:  
operating in a fixed version of the voltage multiplier mode in response to  
the regulated driver voltage being less than a low voltage threshold.

21. The method of claim 19, further comprising:  
operating in a varying region of the voltage multiplier mode in response to  
the regulated driver voltage being greater than a low voltage threshold.
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22. The method of claim 18, further comprising:  
operating in the voltage follower mode in response to the source voltage  
being greater than a high voltage threshold.
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23. The method of claim 18, further comprising:  
operating in the voltage multiplier mode in response to the source voltage  
being less than a high voltage threshold and the regulated driver voltage being less than a  
low voltage threshold.
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24. The method of claim 18, further comprising:  
operating in the voltage follower mode in response to at least one of the  
regulated driver voltage and the source voltage being greater than the high voltage  
threshold.
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25. A voltage regulated transistor driver employed in a system further  
employing a voltage source and at least one transistor, said voltage regulated transistor  
driver comprising:  
means for receiving an electrical communication of a source voltage from  
the voltage source; and
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- means for electrically communicating the regulated driver voltage to the at  
least one transistor,  
wherein, in a voltage multiplier mode, the regulated driver voltage  
is greater than the source voltage, and  
wherein, in a voltage follower mode, the regulated driver voltage  
30 approaches the source voltage to thereby equal or approximate the source voltage.